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# THE OCEANIC CRABS OF THE GENERA PLANES AND PACHYGRAPSUS

By Fenner A. Chace, Jr.

On September 17, 1492, at latitude approximately 28° N. and longitude 37° W., Columbus and his crew, during their first voyage to the New World, "saw much more weed appearing, like herbs from rivers, in which they found a live crab, which the Admiral kept. He says that these crabs are certain signs of land . . . "(Markham, 1893, p. 25). This is possibly the first recorded reference to oceanic crabs. Whether it refers to *Planes* or to the larger swimming crab, *Portunus* (*Portunus*) *sayi* (Gibbes), which is seldom found this far to the east, may be open to question, but the smaller and commoner *Planes* is frequently called Columbus's crab after this item in the discoverer's diary.

Although these crabs must have been a source of wonder to mariners on the high seas in the past as they are today, the first adequate description of them did not appear until more than two centuries after Columbus's voyage when Sloane (1725, p. 270, pl. 245, fig. 1) recorded specimens from seaweed north of Jamaica. A short time later Linnaeus (1747, p. 137, pl. 1, figs. 1, *a–b*) described a similar form, which he had received from a Göteborg druggist and which was reputed to have come from Canton. This specimen, which Linnaeus named *Cancer cantonensis*, may be the first record of the Pacific *Planes cyaneus*. The Atlantic species, found "in Palgi *Fuco natante*," was finally described under the name *Cancer minutus* by Linnaeus in the tenth edition of "Systema Naturae" (1758, p. 625). Bowdich (1825, p. 15, pl. 12, figs. 2, *a–b*) briefly described and figured a crab found on a floating log northeast of Madeira as *Planes clypeatus*.

There is little doubt that Bowdich's species is conspecific with that described earlier by Linnaeus, and the combination *Planes minutus* is now generally accepted for the Atlantic species, despite repeated attempts to substitute *Nautilograpsus* H. Milne-Edwards (1837, p. 90) for *Planes*.

As specimens of *Planes* trickled into collections from all parts of the world in the early part of the nineteenth century, there was a natural tendency to propose new names for varieties from widely separated localities. A dozen different specific names were applied to these crabs between 1775 and 1858. Thereafter the acquisition of larger series of specimens served to illustrate the variability of these forms. All the post-Linnaean names were subsequently synonymized with *P. minutus*, and no additional ones were proposed except *Planes marinus* Rathbun (1914, p. 120). The validity of even that species became more and more questionable as time passed without additional specimens being found.

It was the rediscovery of that form that led to the present study. In December 1947 four crabs were found among marine organisms attached to a derelict Japanese mine that drifted ashore at Lincoln Beach, Oreg. These proved to be the species described by Dr. Rathbun and not reliably reported since her record of the type series taken in the Pacific Ocean west of Baja California. Search of the uncataloged collections in the U. S. National Museum revealed two more specimens of this species, these from the Hawaiian Islands. A subsequent query addressed to Dr. C. H. Edmondson at the Bernice P. Bishop Museum in Honolulu led to the discovery of several lots in that institution. A comparison of this form with specimens of *Planes minutus* indicates that the two are generically as well as specifically distinct and that there are at least two species of *Planes* s. s., one found in the Atlantic and one in the Pacific.

No attempt is made here to delimit these oceanic forms completely either taxonomically or geographically. Additional material from critical areas and "hosts" must be studied before this can be done. It has been my aim to bring together as many of the scattered references to these species as possible in the hope that workers elsewhere may be encouraged to re-examine material at their disposal or to collect specimens from other areas with a view to verifying or modifying the conclusions outlined here. A species believed to be identical and common in all the warmer seas of the world soon loses its interest; collectors fail to take the trouble to preserve specimens when they are found, and museum workers neglect to examine critically those that are received. If this trend can be reversed as far as these crabs are concerned, it is not unlikely that interesting findings related to speciation and zoogeography may be forthcoming.

Practically none of the references to *Planes* in the literature are determinable to species except on a geographic basis. The synonymies listed below have been compiled more or less arbitrarily, all the records from the Atlantic and Indian Oceans being credited to *P. minutus* and those from the Pacific to *P. cyaneus*. It is very possible that this disposition, particularly as it concerns the Indian Ocean forms, may have to be altered when additional data are obtained.

This opportunity is taken to thank those persons whose gracious assistance has made this study possible: Dr. Louis W. Hutchins, of the Woods Hole Oceanographic Institution, for furnishing the specimens of *Pachygrapsus marinus* which prompted the survey; John C. Armstrong, of the American Museum of Natural History, Dr. Elisabeth Deichmann, of the Museum of Comparative Zoology, and Dr. C. H. Edmondson, of the Bernice P. Bishop Museum, for providing loans of critical specimens; Mr. and Mrs. Boonyong Nikrodhananda, of Bangkok, Siam, for making a cursory survey of drifting objects that might harbor crabs, during an extended transpacific voyage; and finally my colleagues in the U. S. National Museum for their assistance and encouragement during the preparation of this paper.

## MORPHOLOGICAL CHARACTERS

The species of *Planes* are extremely variable. This fact has led to the general abandonment of all previous attempts to recognize more than one species in the genus. When Stimpson (1860, p. 231) made the statement that "we are unable to distinguish the specimens [from Baja California] from those collected from Gulfweed in the North Atlantic," the conspecific status of the various forms of *Planes* seemed to be finally established, and few subsequent attempts to delimit other than the genotype were attempted; even the validity of the very distinct form described as *Planes marinus* by Dr. Rathbun has been questioned.

The present study indicates, however, that at least some of the variable characters involved show a discontinuity between the Atlantic and Pacific forms of the genus (table 1). Probably the most useful of these characters is based on the relative lengths of the walking legs. In *P. cyaneus* from the Pacific the legs are noticeably shorter than in *P. minutus* from the Atlantic and Indian Oceans. This difference in relative leg length is not so apparent in figure 1 as it would be if specimens of *P. minutus* and *P. cyaneus* of similar carapace lengths had been available for figuring. The discrepancy is more obvious in figure 2, *d*, *e*, where legs from specimens of similar size are compared. It was found that the simplest way to demonstrate this difference is to compare the combined lengths of the three distal segments of the second walking leg with the carapace length (figs. 6, 7). The slight overlap in this character between the Atlantic and Pacific forms may

be a real one, or it may be a result of contraction or expansion of the leg in preservative or of the possibility that regenerating and not fully developed legs of *P. minutus* have been included among the material measured.

TABLE 1.—*Synopsis of characters*

| Characters | *Planes minutus* | *Planes cyaneus* | *Pachygrapsus marinus* |
|---|---|---|---|
| CARAPACE: | | | |
| Length | 3.7 to 19 mm | 5 to 25 mm | 5 to 19 mm. |
| Proportions (see fig. 4) | About as wide as long, length to width as 1:0.91 to 1.12. | Usually slightly longer than wide, length to width as 1:0.86 to 1.06. | Distinctly wider than long, length to width as 1:1.07 to 1.16. |
| Shape (see fig. 3) | Subquadrate in young (3.7–6 mm.); trapezoidal in medium sized (6–12 mm.); laterally convex in old specimens (12–19 mm.). | Laterally convex at all ages. | Subquadrate at all ages. |
| Surface of branchial regions. | Faintly striate laterally | Faintly striate laterally | Distinctly striate laterally. |
| MALE ABDOMEN: | | | |
| Shape (see fig. 2, *g–i*) | Rather broadly triangular, length of four distal segments about 1.24 times basal width of fourth segment. | Narrowed beyond third segment, length of four distal segments about 1.26 times basal width of fourth segment. | Broadly triangular, length of 4 distal segments about 1.08 times basal width of fourth segment. |
| Terminal segment | Rather narrowly triangular, about as long as basal width. | Laterally convex, about 0.9 as long as basal width. | Broadly triangular, about 0.9 as long as basal width. |
| CHELAE: | | | |
| Fixed finger (see fig. 2, *a–c*). | Bent sharply downward, especially in males. | Bent sharply downward, especially in males. | Not noticeably bent downward. |
| Surface of hand | With prominent sharp granules near lower margin. | With prominent sharp granules near lower margin. | Few inconspicuous granules near lower margin. |
| WALKING LEGS: | | | |
| Form (see fig. 2, *d–f*) | Long, slender, and flattened. | Short, slender, and flattened. | Rather short, stout, and not noticeably flattened. |
| Hairs on upper anterior margin of propodus of three anterior pairs. | Forming a natatory fringe. | Forming a natatory fringe. | Stout and forming a dense growth without a natatory fringe. |
| Proportion of length of three distal segments of second pair to carapace length (see fig. 6). | 0.83 to 1.07 | 0.68 to 0.89 | 0.77 to 0.99. |

*Planes cyaneus* appears to be a somewhat larger form than *P. minutus*. The smallest specimens of the latter examined measure 3.7 mm. in carapace length, and the largest 19 mm. Comparable measurements for *P. cyaneus* are 5 and 25 mm. The mean carapace width is usually about the same as the mean length in *P. minutus*, whereas it is somewhat less in *P. cyaneus* (figs. 4, 5); this character is demonstrable only in long series of specimens, however, and is of far less importance than the length of the walking legs.

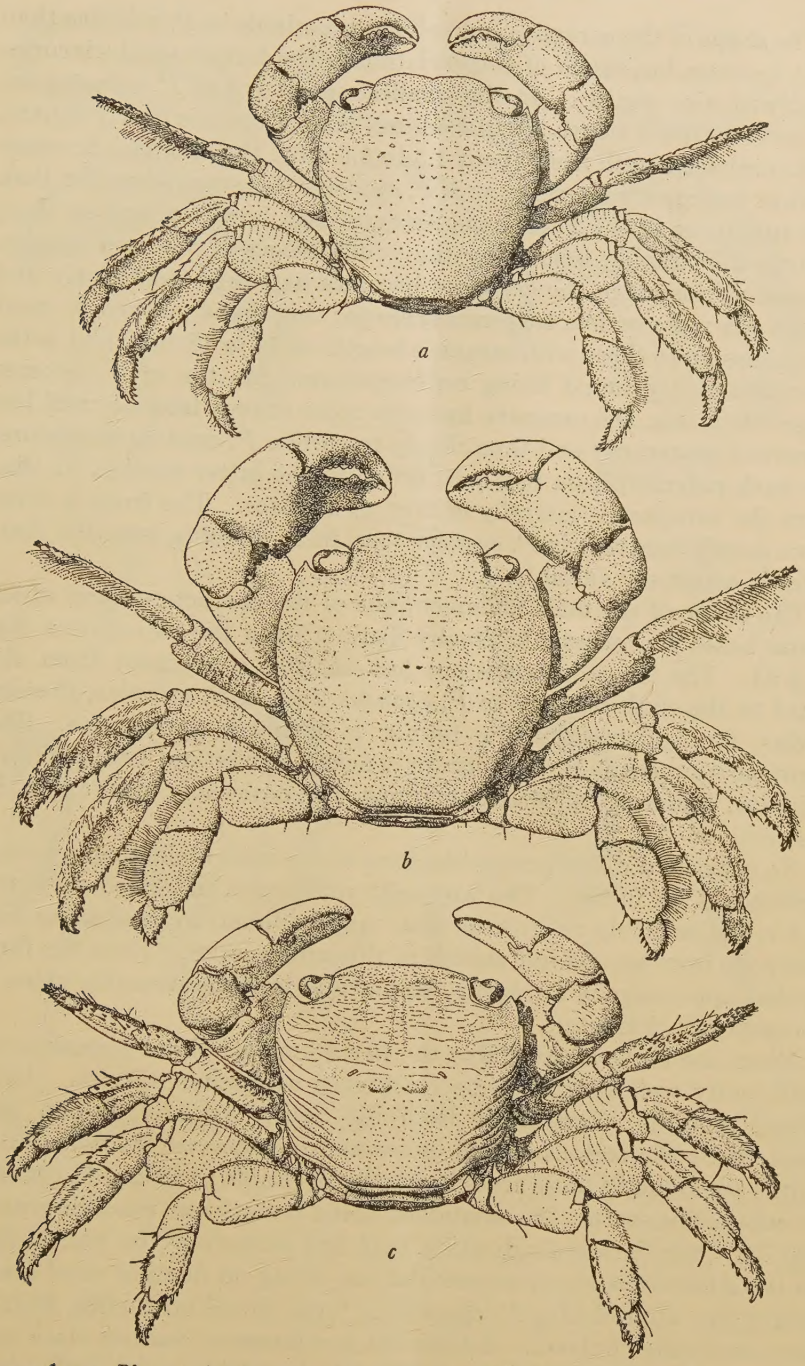


FIGURE 1.—*a, Planes minutus*, male (U. S. N. M. No. 4558), carapace 13.4 mm. long *b, Planes cyaneus*, male (U.S.N.M. No. 20695), carapace 16.6 mm. long; *c. Pachygrapsus marinus*, male paratype (U.S.N.M. No. 22833), carapace 13.8 mm. long.

The shape of the carapace is much more variable in *P. minutus* than in *P. cyaneus*, but much of the variation in the former species is correlated with size (fig. 3). In the smallest specimens of *P. minutus* examined (carapace length 3.8 to 4.5 mm.) the carapace is nearly square. At a carapace length from about 4.5 to 5.5 mm., the carapace becomes more or less convex laterally, as in *P. cyaneus;* this stage is smaller than any specimens of the Pacific species examined, however, and so there is little difficulty in separating the young stages of the two species. Following this stage the carapace becomes narrowed posteriorly and assumes a more or less trapezoidal shape; this shape persists in most specimens up to those with carapace lengths of 11 or 12 mm. and is the form commonly found living on *Sargassum*. As the crab becomes larger than this, the carapace becomes more convex laterally and less narrowed posteriorly and thus closely resembles *P. cyaneus* once more. No such polymorphism has been noted in the latter species; in that form the carapace is laterally convex at all sizes. The front is often more deeply excavate in *P. cyaneus* than in *P. minutus*, but this character is extremely variable.

The shape of the male abdomen, one of the characters upon which Dana based *P. cyaneus*, is usually distinctive in the two species (fig. 2, *g*, *h*). The lateral margins are less sharply convergent from the third to the sixth segment in *P. cyaneus* than in *P. minutus*, thereby giving the abdomen of the former a narrower appearance. The terminal segment is in the form of a nearly equilateral triangle in *P. minutus*, whereas its lateral margins are noticeably convex in *P. cyaneus*.

No consistent differences in the form of the male abdominal appendages could be found. The apparent differences indicated in figure 2, *j–r*, are probably no greater than may be found by examining first pleopods from several individuals of the same species. Even the form of that appendage in *Pachygrapsus marinus* is of questionable value as a taxonomic character.

From the material available the two forms of *Planes* appear to be sufficiently well marked to be recognized as distinct species. Additional material, particularly from the South Atlantic, Indian, and western Pacific regions should be examined, however; if intermediate forms are found in those areas it may be advisable to reduce *P. cyaneus* to subspecific status. As mentioned in the remarks on relative growth (p. 73), there is some indication that two forms may be represented in the Atlantic: a small trapezoidal one living on floating weed and a larger one, approaching *P. cyaneus* in form, found on turtles, floating logs, and other flotsam. Additional specimens of various sizes from the latter habitat should be examined to determine whether this form is distinct or not.

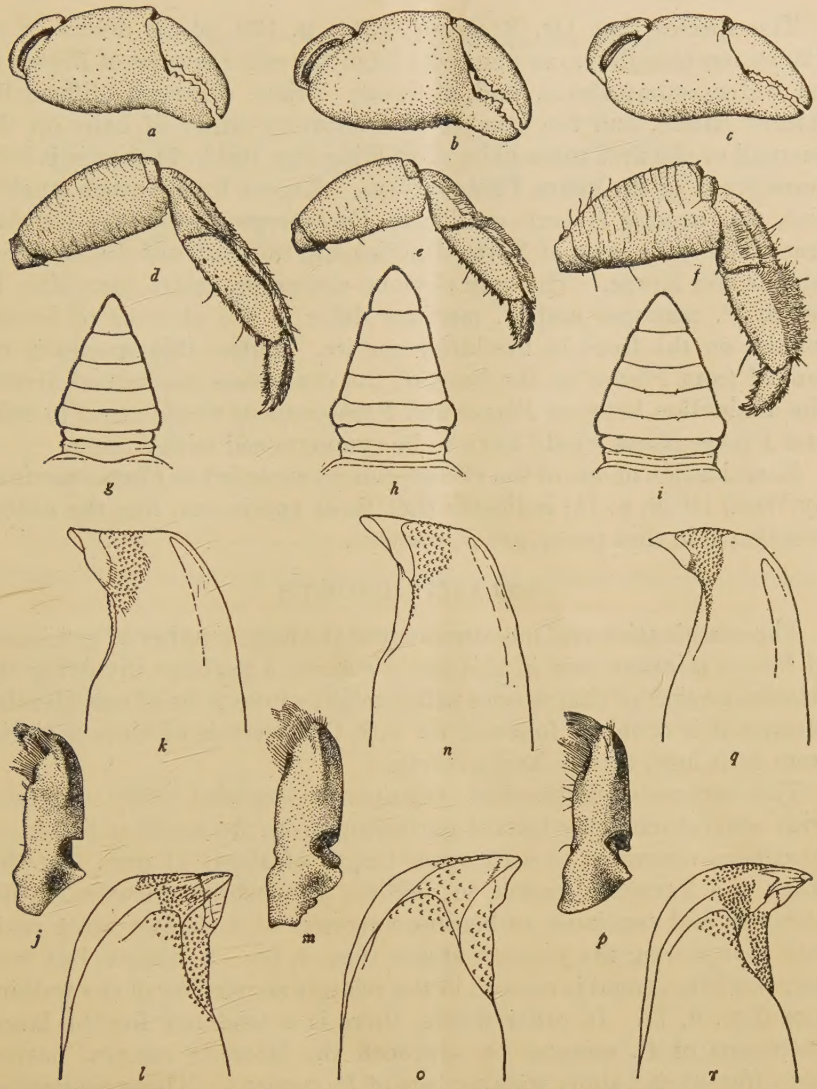


FIGURE 2.—*a*, Right chela of *Planes minutus*, male (U.S.N.M. No. 4558), carapace 13.4 mm. long; *b*, right chela of *Planes cyaneus*, male (U.S.N.M. No. 17449), carapace 15.9 mm. long; *c*, right chela of *Pachygrapsus marinus*, male paratype (U.S.N.M. No. 22833), carapace 13.8 mm. long; *d*, right second walking leg of *Planes minutus*, male (U.S.N.M. No. 17712), carapace 15.5 mm. long; *e*, right second walking leg of *Planes cyaneus*, male (U.S.N.M. No. 20700), carapace 15.3 mm. long; *f*, right second walking leg of *Pachygrapsus marinus*, male (U.S.N.M. No. 88069), carapace 15.1 mm. long; *g*, Abdomen of *Planes minutus*, male (U.S.N.M. No. 4558), carapace 13.4 mm. long; *h*, abdomen of *Planes cyaneus*, male (U.S.N.M. No. 20695), carapace 16.6 mm. long; *i*, abdomen of *Pachygrapsus marinus*, male paratype (U.S.N.M. No. 22833), carapace 13.8 mm. long; *j*, first right pleopod, mesicocaudal view, of *Planes minutus*, male (U.S.N.M. No. 4558), carapace 13.4 mm. long; *k*, denuded tip of first right pleopod, mesiocaudal view, of *Planes minutus*, male (U.S.N.M. No. 17712), carapace 15.5 mm. long; *l*, same, laterocephalic view; *m*, first right pleopod, mesiocaudal view of *Planes cyaneus*, male (U.S.N.M. No. 20695), carapace 16.6 mm. long; *n*, denuded tip of same, mesiocaudal view; *o*, same, laterocephalic view; *p*, first right pleopod, mesiocaudal view, of *Pachygrapsus marinus*, male paratype (U.S.N.M. No. 22833), carapace 13.8 mm. long; *q*, denuded tip of same, mesiocaudal view; *r*, same, laterocephalic view.

The species that Dr. Rathbun (1914, p. 120, pl. 3) described as *Planes marinus* differs so markedly from the other species of *Planes* in its wider, subquadrate, and distinctly striate carapace, differently formed chelae, and the absence of a natatory fringe of hairs on the propodi of the first three pairs of walking legs (table 1) that it is here transferred to the genus *Pachygrapsus*. Except for its much smaller size, this species is very similar to *Pachygrapsus crassipes* Randall from the Pacific coast of North America and the shores of the Japanese islands and Korea. The only obvious character, apart from size, in which *P. crassipes* and *P. marinus* differ is the absence of lateral lobules on the front in the latter species. Unless this species is removed from *Planes* on the basis of the characters mentioned above, the distinction between *Planes* and *Pachygrapsus* would cease to exist and *Pachygrapsus* would have to be synonymized with *Planes*.

Examination of one of the two specimens recorded as *Planes marinus* by Ward (1939, p. 14) indicates that these specimens, like the others mentioned in that paper, are *P. cyaneus*.

## RELATIVE GROWTH

The examination and measurement of the large number of specimens of *Planes minutus* used in this study suggest a problem involving the relative growth of that species which might prove to be of considerable interest if it could be followed up with the analysis of more material from drift logs, turtles, and so forth.

The carapace length-width relationship remains fairly constant, with a slight tendency toward narrowing, from the smallest immature specimens examined to a carapace length of about 11 mm. At this stage the carapace seems to become somewhat narrower rather abruptly and continues to become narrower at a slightly more rapid rate than during the younger stages (figs. 4, 5). A similar, but even more striking, trend is noticed in the relative shortening of the walking legs (figs. 6, 7). In other words, there is a tendency for the larger specimens of *P. minutus* to approach the laterally convex, narrow form (fig. 3) and short walking legs of *P. cyaneus*. These similarities are so striking that I was at first led toward the belief that the larger Atlantic specimens are conspecific with those from the Pacific. It will be seen from figures 4 through 7, however, that the mean width of the carapace in the Atlantic form never becomes quite as narrow relative to the length as in the Pacific form, and the legs are always distinctly longer in the Atlantic species (tables 2, 3).

Although the material at hand has not been sufficiently well documented to verify the hypothesis, it is not improbable that most of the specimens of *P. minutus* having a carapace length of more than about 11 mm. are not found on *Sargassum*, but on flotsam and turtles. The

TABLE 2.—*Mean values of carapace proportions*

| *Planes minutus* | | | *Planes cyaneus* | | | *Pachygrapsus marinus* | | |
|---|---|---|---|---|---|---|---|---|
| Number of specimens | Mean carapace length | Mean carapace width | Number of specimens | Mean carapace length | Mean carapace width | Number of specimens | Mean carapace length | Mean carapace width |
| | *Millimeters* | *Millimeters* | | *Millimeters* | *Millimeters* | | *Millimeters* | *Millimeters* |
| 57 | 4.2 | 4.2 | ------ | ------ | ------ | ------ | ------ | ------ |
| 89 | 5.0 | 5.1 | ------ | ------ | ------ | ------ | ------ | ------ |
| 78 | 6.0 | 6.2 | 15 | 6.2 | 6.0 | ------ | ------ | ------ |
| 76 | 7.0 | 7.3 | ------ | ------ | ------ | 6 | 6.9 | 7.7 |
| 76 | 8.0 | 8.3 | 8 | 8.3 | 8.3 | ------ | ------ | ------ |
| 53 | 9.0 | 9.4 | ------ | ------ | ------ | 8 | 8.7 | 9.8 |
| 46 | 10.0 | 10.4 | ------ | ------ | ------ | ------ | ------ | ------ |
| 22 | 10.9 | 11.2 | ------ | ------ | ------ | ------ | ------ | ------ |
| 9 | 12.4 | 12.7 | 11 | 11.8 | 11.6 | 6 | 12.3 | 13.9 |
| 10 | 14.3 | 14.7 | 12 | 14.1 | 14.2 | 16 | 14.0 | 15.8 |
| ------ | ------ | ------ | ------ | ------ | ------ | 7 | 15.5 | 17.4 |
| 9 | 17.0 | 17.3 | 10 | 17.3 | 17.2 | 5 | 17.6 | 19.9 |
| ------ | ------ | ------ | 2 | 22.6 | 22.5 | ------ | ------ | ------ |

TABLE 3.—*Mean values of total length of three distal segments of second walking leg*

| *Planes minutus* | | | *Planes cyaneus* | | | *Pachygrapsus marinus* | | |
|---|---|---|---|---|---|---|---|---|
| Number of specimens | Mean carapace length | Mean length of leg segments | Number of specimens | Mean carapace length | Mean length of leg segments | Number of specimens | Mean carapace length | Mean length of leg segments |
| | *Millimeters* | *Millimeters* | | *Millimeters* | *Millimeters* | | *Millimeters* | *Millimeters* |
| 16 | 4.2 | 4.1 | ------ | ------ | ------ | ------ | ------ | ------ |
| 46 | 5.0 | 5.0 | ------ | ------ | ------ | ------ | ------ | ------ |
| 46 | 6.0 | 6.0 | 15 | 6.3 | 5.1 | ------ | ------ | ------ |
| 52 | 7.0 | 7.0 | ------ | ------ | ------ | 4 | 7.3 | 6.8 |
| 54 | 7.9 | 7.8 | 8 | 8.2 | 6.6 | ------ | ------ | ------ |
| 45 | 8.9 | 8.7 | ------ | ------ | ------ | 7 | 8.7 | 7.8 |
| 41 | 9.9 | 9.6 | ------ | ------ | ------ | ------ | ------ | ------ |
| 21 | 10.9 | 10.3 | 12 | 11.6 | 9.0 | ------ | ------ | ------ |
| 15 | 12.6 | 11.6 | ------ | ------ | ------ | 6 | 12.3 | 10.4 |
| 12 | 14.5 | 13.0 | 12 | 14.1 | 10.5 | 16 | 14.0 | 11.8 |
| 12 | 16.3 | 14.4 | ------ | ------ | ------ | 7 | 15.5 | 12.8 |
| 4 | 18.3 | 16.0 | 10 | 17.0 | 13.1 | 5 | 17.6 | 14.2 |
| ------ | ------ | ------ | 5 | 22.5 | 16.9 | ------ | ------ | ------ |

shorter legs may be better adapted to this more sessile existence or, conversely, the longer legs of the smaller individuals may be advantageous in scurrying and swimming about among the floating weed. Whether there is a gradual reduction in the relative lengths of the legs with the transfer of the animal to a different means of transport or whether there are two forms of *Planes* in the North Atlantic—a small, trapezoidal form that spends its entire life on floating weed and a larger, laterally convex, and short-legged form that lives only on flotsam and turtles—can be determined only when more material,

particularly of immature specimens, from flotsam and turtles is available for study.

Similar trends are not apparent in the specimens of *Planes cyaneus* or *Pachygrapsus marinus*, but the relative growth of these two species cannot be reliably demonstrated from the material studied.

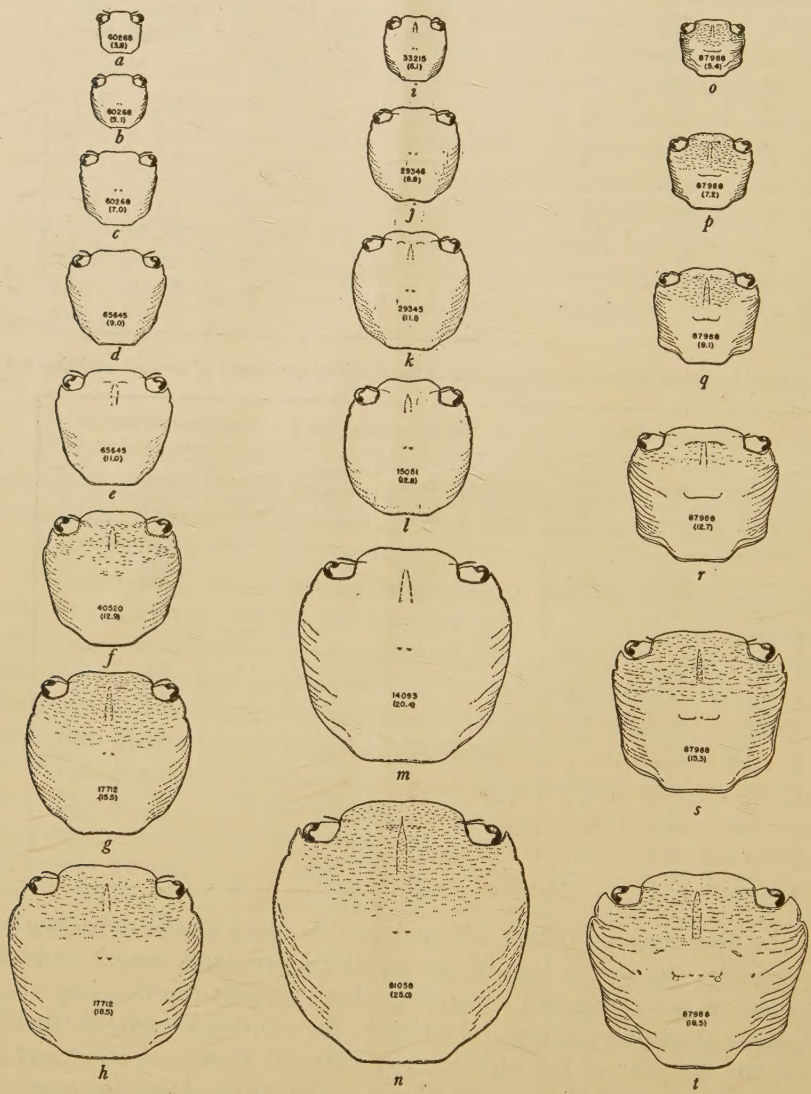


FIGURE 3.—Carapace growth in males of *Planes minutus* (*a-h*), *Planes cyaneus* (*i-n*), and *Pachygrapsus marinus* (*o-t*). The figures denote the U.S.N.M. catalog numbers and, in parentheses, the carapace lengths in mm.

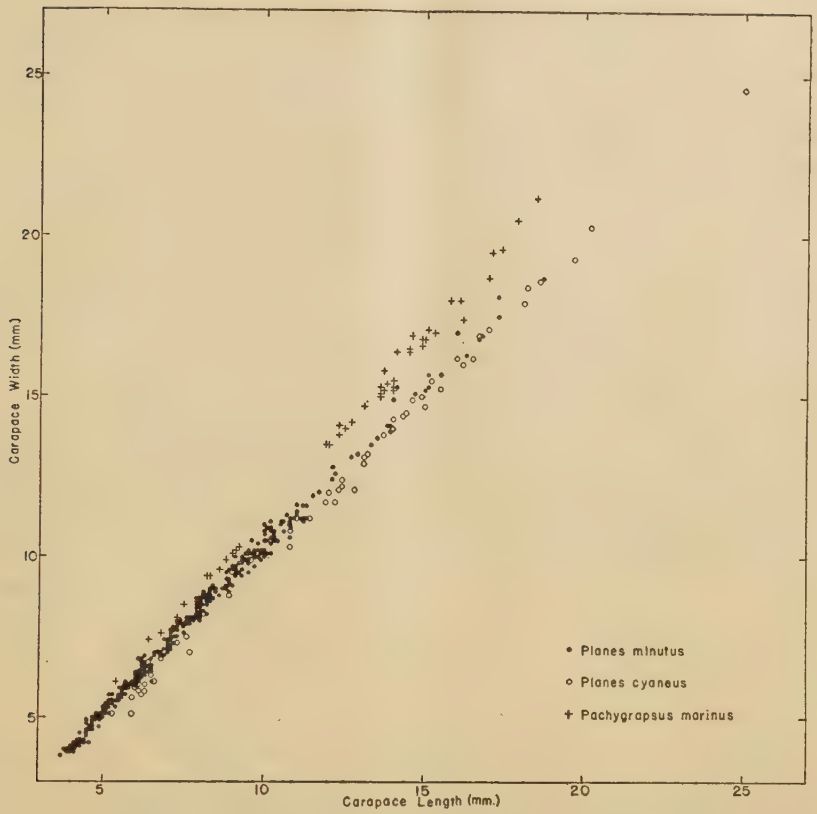


FIGURE 4.—Scatter diagram showing the variation in proportions of the carapace in *Planes minutus*, *Planes cyaneus*, and *Pachygrapsus marinus*.

## COLOR

The variable and protective coloration of *Planes minutus* has been a cause of speculation for more than a century. Some of the early workers believed that those specimens which were greenish or brownish yellow mottled with darker shades of the same color sought out *Sargassum* clumps to live on in order to be less conspicuous to their enemies. These *Sargassum* inhabitants also often have a large white or yellowish patch on the dorsal surface, which seems to duplicate the patches of bryozoan colonies with which the plant fronds are almost invariably encrusted. Those specimens found on turtles are usually yellowish, those on logs and drifting trees often dark reddish brown, and those on the pelagic gastropod *Janthina* lilac blue. Light reddish shades have also been recorded on several occasions. Examples of some of these colors are shown in Murray and Hjort (1912, pl. 6).

Müller (1881, p. 473) was apparently the first to suggest that these crabs change their color according to the object to which they cling.

Not until a few years ago, however, was the nature of this change demonstrated. Dr. Hitchcock (1941, pp. 26–30) found that the chromatophores of specimens of *P. minutus* he investigated at Bermuda were responsive to white, black, red, blue, yellow, and green backgrounds, but that there was no immediate change in the general color of the crab because of the extracellular pigment in the hypodermis and exoskeleton. These findings seem to indicate that the apparent color of any particular specimen can be changed only at the time of molting, and any individual that moves to a differently colored background subsequent to hardening of the shell would cease to be protectively colored. Interesting results might be obtained by confining molting specimens to backgrounds of various colors and patterns.

The color of *P. cyaneus* has been recorded as cerulean blue, bluish gray mottled with brown, yellowish clouded with brown, and reddish brown. It is probable that a type of color change comparable to that in *P. minutus* occurs in this species as well, although no similar experiments on it have been attempted.

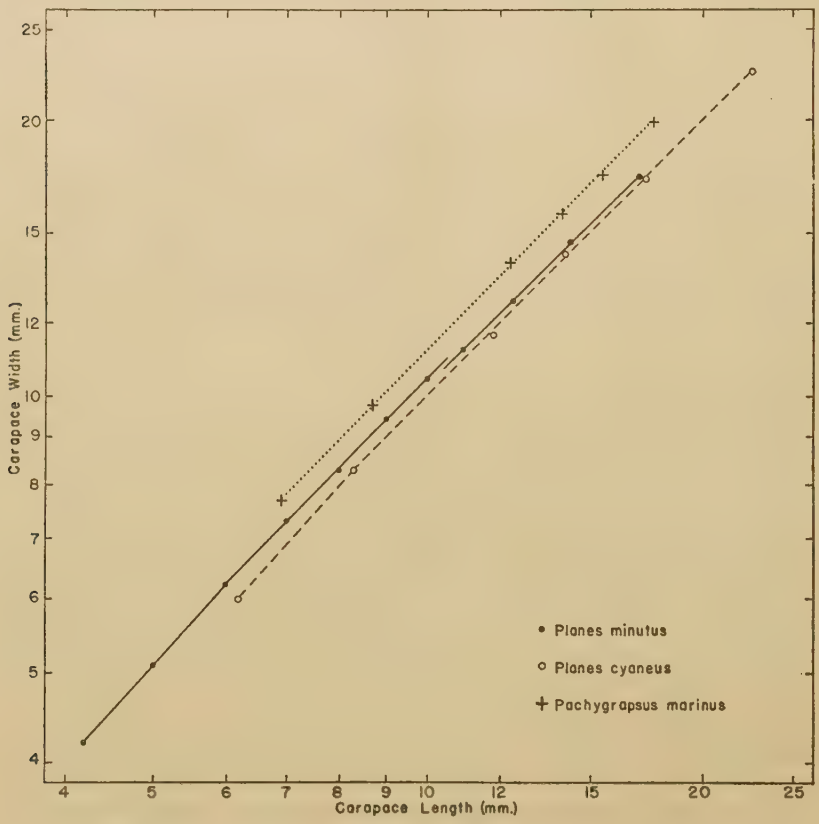


FIGURE 5.—Relative growth of the carapace in *Planes minutus*, *Planes cyaneus*, and *Pachygrapsus marinus*, based on mean values (table 2) plotted logarithmically.

The color in life of *Pachygrapsus marinus* has not been published. The specimens from a Japanese mine which prompted this survey were rather dark reddish brown a short time after preservation in alcohol.

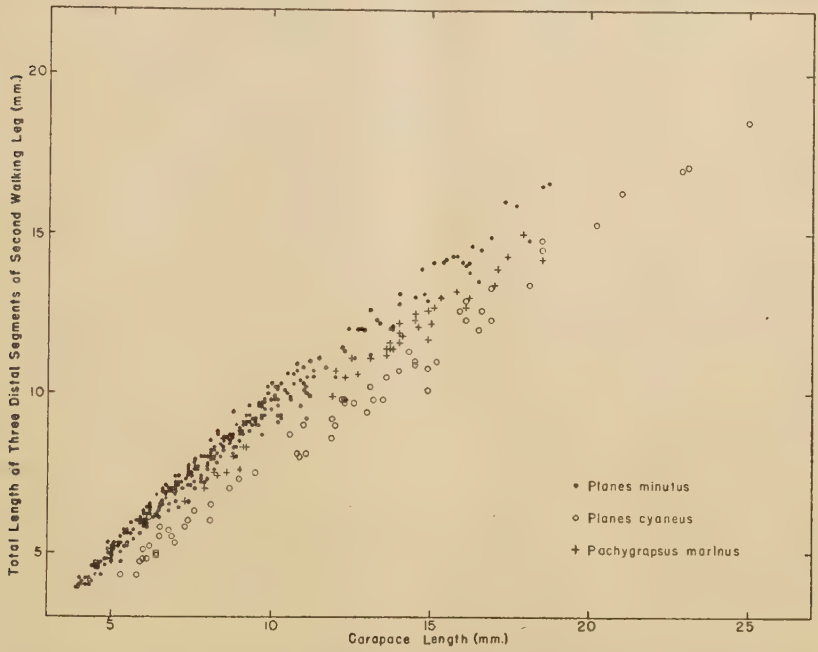


FIGURE 6.—Scatter diagram showing the variation in the combined length of the three terminal segments of the second walking leg in *Planes minutus*, *Planes cyaneus*, and *Pachygrapsus marinus*.

## FOOD

The only published record of the stomach contents of any of these species is that of Miss Crane (1937, p. 78) based on a large ovigerous female of *Planes cyaneus* taken from the tail of a green turtle. The stomach of this specimen contained finely digested animal matter. Miss Crane suggests the possibility that this food material might represent the excrement of the turtle. Some support is given to this theory by the fact that larger specimens of *Planes* are commonly found around the tail and hind legs of turtles. Specimens living on other objects, however, must be able to assimilate less digested food.

## DISTRIBUTION

The relative abundance of these oceanic crabs is more or less dependent upon the prevalence of flotsam or of floating or swimming organisms to which the crabs may cling. They are therefore found far more commonly on *Sargassum* in the Sargasso Sea area of the North Atlantic than in any other part of the world. Records of their occur-

rence in other areas are still too scattered and frequently too unreliable to justify the usual distribution note that *Planes* is "found in all tropical and temperate seas."

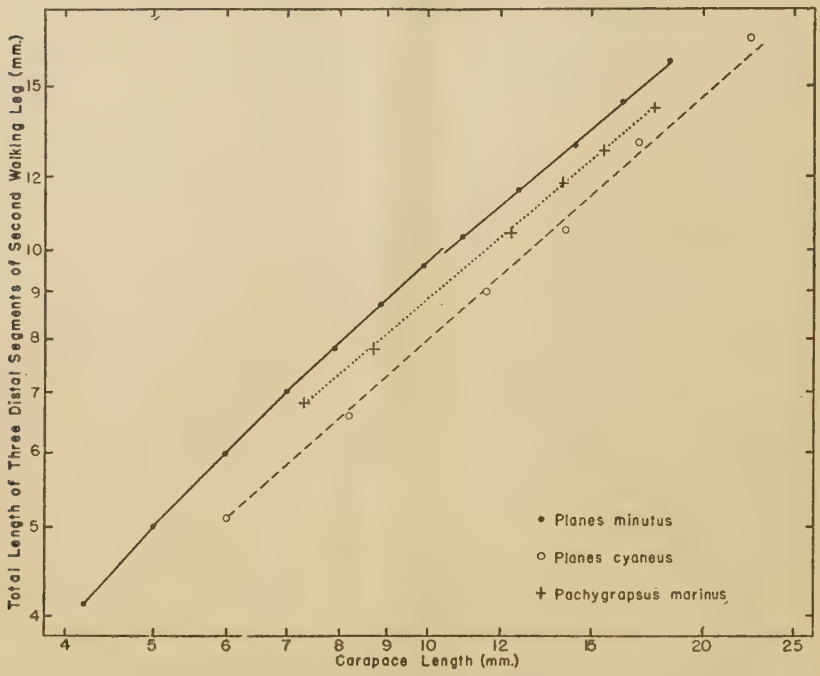


FIGURE 7.—Relative growth of the three terminal segments of the second walking leg in *Planes minutus*, *Planes cyaneus*, and *Pachygrapsus marinus*, based on mean values (table 3) plotted logarithmically.

The more reliable locality records for the species of *Planes* are indicated in figure 8. Not included on this chart are several references in the literature to Australian specimens without specific locality data. Even some of the localities indicated, particularly those from older records, require verification. It is obvious that in some cases specimens picked up at sea have been referred to the last port of call of the vessel involved. The large lot of specimens recorded by Dr. Rathbun (1918, p. 257) from the Galápagos Islands (U.S.N.M. No. 5046) prove to belong to the Atlantic *Planes minutus*. This determination is substantiated by the fact that the shrimp from the same collection belong to the *Sargassum* fauna of the North Atlantic. Similar circumstances may explain the record of the single specimen of *P. cyaneus* from Mauritius (U.S.N.M. No. 17667) if the presence of *P. minutus* alone in the Indian Ocean is borne out by other material. Even one of the lots of *P. minutus* from that region, that from Kerguelen Island (U.S.N.M. No. 15054), is questionable; in the collections of

the U. S. National Museum is a specimen of *Portunus* (*Portunus*) *sayi* (Gibbes) that bears the same locality data, and this crab is otherwise reliably reported only from the Atlantic. Examination of additional material from the Indian Ocean will be necessary before it can be definitely ascertained whether one or both species occur there. The fact that Alcock (1900) recorded no specimens of the genus indicates that it is not a common component of the Indian fauna.

One of the most interesting aspects of the distribution of *Planes* is its apparent absence from the Gulf of Mexico west of the Dry Tortugas despite its relative abundance from the Straits of Florida eastward and its occurrence in the Caribbean area. Joel W. Hedgpeth, of the Institute of Marine Science at Port Aransas, Tex., and Dr. Allan F. Archer, of the Alabama Museum of Natural History, inform me that they have never encountered the crab although they have searched through great masses of *Sargassum* from the Gulf. It would be interesting to know what factor or factors preclude the dispersion of *Planes* into an area such as this where the presence of floating weed and particularly of sea turtles would seem to afford ideal sources of attachment for the crabs.

There are likewise very few records of the presence of *Planes* in the central South Atlantic, possibly because of the comparatively small amount of exploratory work done in that extensive region. If the occurrence of *P. minutus* in the Indian Ocean is finally confirmed, it would be of considerable interest to know more of the distribution of the genus in the South Atlantic, particularly whether the Pacific *P. cyaneus* extends into the western part of the South Atlantic and, if it does, whether the ranges of the two species overlap there. Inasmuch as *Planes* is not infrequently found among the under-water growth on ships' hulls and as the crabs are said to be common in the Straits of Magellan (Jacquinot and Lucas, 1853, p. 78), through which much of the steamship traffic passed in the early part of this century, it would be remarkable if intermingling of the two forms had not occurred commonly in the past.

The known distribution of *Pachygrapsus marinus* is limited to the records from the coast of Oregon and the Hawaiian Islands, in addition to the type locality west of Baja California; further collecting will probably show its range to be far more extensive in the eastern North Pacific and possibly in the western portion as well. Dr. C. H. Edmondson informs me that, of 18 lots and 150 or more specimens identified as *Planes minutus* in the Bernice P. Bishop Museum, 3 lots containing a total of 22 specimens are apparently *Pachygrapsus marinus* and 3 of the remaining 15 lots contain both *Planes* and *Pachygrapsus*, including 30 or more specimens of the latter. All the lots containing *Pachygrapsus marinus* were taken off Oahu.

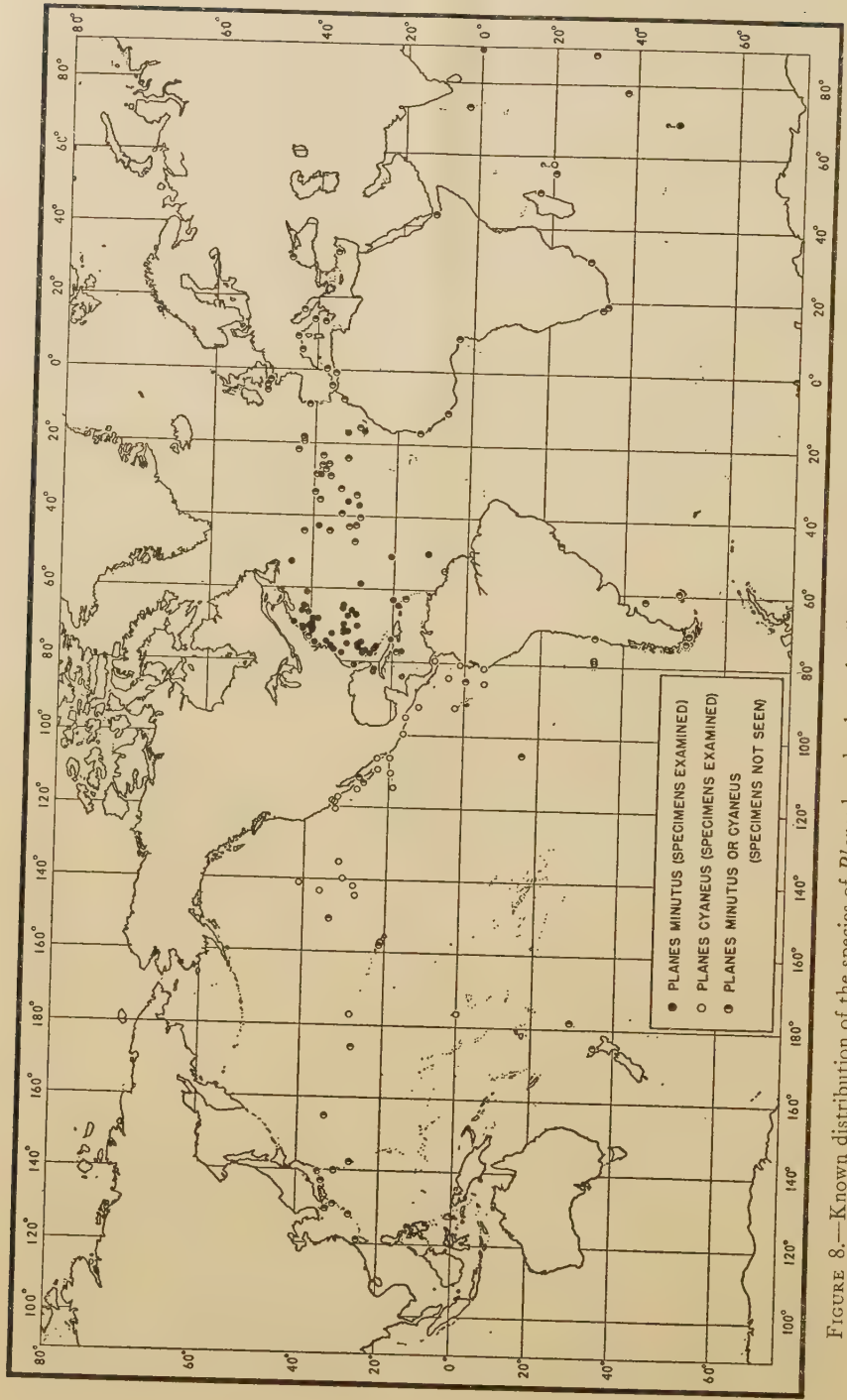


FIGURE 8.—Known distribution of the species of *Planes* based only on locality records that are apparently valid and reasonably exact.

## Genus PLANES Bowdich

### PLANES MINUTUS (Linnaeus)

*Cancellus marinus minimus quadratus* SLOANE, 1725, p. 270, fig. 1 ("on the *Sargasso* and other Submarine Sea-Plants, on the Northside of Jamaica").

*Cancer minutus* LINNAEUS, 1758, p. 625 ("Habitat in Palgi *Fuco natante*, supra aquam saepius cursitans"); 1767, p. 1040 [2040] (west Europe and "Pelagi *Fuco natante*").—OSBECK, 1771, p. 116 (Sargasso Sea).—FABRICIUS, 1775, p. 402.—MÜLLER, O. F., 1776, p. 195.—PENNANT, 1777, p. 3, pl. 1, fig. 2 (British shores, among algae).—FABRICIUS, 1781, p. 497.—HERBST, 1783, p. 110, pl. 2, fig. 32.—FABRICIUS, 1787, p. 316.—OLIVIER, 1791, pp. 143, 154. —FABRICIUS, 1793, p. 443 ("In Pelago frequens").

*Cancer pusillus* FABRICIUS, 1775, p. 402 ("in Oceano boreali").—HERBST, 1783, p. 112.—FABRICIUS, 1787, p. 316.—OLIVIER, 1791, pp. 143, 155.—FABRICIUS, 1793, p. 443.

Turtle-Crab BROWNE, 1789, p. 421, pl. 42, fig. 1 ("on the back of a turtle, near the western islands").

*Pinnotheres glaberimus* BOSC, 1801–02, p. 244 ("dans la haute mer sur les fucus"). Not *Cancer glaberrimus* Herbst, 1790.

*Pinnotheres minutus* BOSC, 1801–02, p. 244.

*Pinnotheres pusillus* BOSC, 1801–02, p. 244.

*Grapsus minutus* LATREILLE, 1802–03, p. 68.—LEACH, 1814, p. 430.

*Grapsus cinereus* SAY, 1817, p. 99 (Gulf Stream, common). Not *G. cinereus* Bosc, 1802.

*Grapsus pelagicus* SAY, 1818, p. 442.—ROUX, 1828, p. 55, pl. 6, figs. 7–9 (off Sardinia, on turtles).—HITCHCOCK, E., 1835, p. 29 (Gulf Stream, on seaweed).—THOMPSON, J. V., 1836, p. 374 (off America, on gulfweed, abundant).—MILNE-EDWARDS, H., 1852, p. 174.

*Planes clypeatus* BOWDICH, 1825, p. 15, pl. 12, figs. 2a-b (northeast of Madeira, on water-logged logs of American pine, in great numbers among *Lepas anatifera*).

*Grapsus testudinum* ROUX, 1828, p. 52, pl. 6, figs. 1–6 (under folds of skin of legs and anus of turtles).

*Nautilograpsus minutus* MILNE-EDWARDS, H., 1837, p. 90.—MACLEAY, 1838, p. 66 (Atlantic, on gulfweed).—KRAUSS, 1843, p. 44 (Gulf Stream).—DE KAY, 1844, p. 15 (off New York harbor, on seaweed).—GOODSIR, 1845, p. 73, pl. 7, fig. 1 (lat. 25° to 36° N., long. 40° W.; lat. 40° N.).—GIBBES, 1850, p. 182 [18].—MILNE-EDWARDS, H., 1852, p. 174.—STIMPSON, 1858, p. 103 [49] (North Atlantic, common in *Sargassum*).—MILNE-EDWARDS, A., 1862, p. F–6 (Réunion Island, Indian Ocean).—HELLER, 1863, p. 114 (African coast of Mediterranean; Cyprus; Genoa; Lesina); 1865, p. 50 (Sargasso Sea).—SMITH and HARGER, 1874, p. 26 (off Georges Bank; lat. 41°25′ N., long. 65°05–30′ W.).—BROCCHI, 1875, p. 80, pl. 17, fig. 133.—MAN, 1879, p. 69 (part: Atlantic Ocean).—MOSELEY, 1879, p. 568 (Sargasso Sea, on *Sargassum*).—SMITH, 1879, p. 120 (Bermuda; lat. 41°20–30′ N., long. 65° to 65°30′ W.); 1880, p. 263 (Woods Hole, Mass.).—STOSSICH, 1880, p. 192 (Lesina).—WAGNER, 1880, p. 96.—KINGSLEY, 1881, p. 202 (part: Gulf Stream; West Indies; Surinam; Falkland Islands [?]; Natal; Rio Gambia; France).—CZERNIAVSKY, 1884, p. 135 (Odessa).—MILNE-EDWARDS, A., 1884, p. 25 (Sargasso Sea, on *Sargassum*).—CARUS, 1885, p. 524.—VERRILL, 1885, p. 591 (Gulf Stream, common, usually clinging to clusters of floating seaweeds).—MIERS, 1886, p. 254 (part: Gomera, Canary Islands; between Bermuda and Azores; off Sombrero Island, West Indies; northwest Atlantic,

on gulfweed; North Atlantic, on *Fucus*).—POUCHET and GUERNE, 1886, p. 878 (Azores, from stomach of turtle, *Thalassochelys caretta*).—SMITH, 1886, p. 618.—BARROIS, 1888, p. 15 (Ponta-Delgada, Sao Miguel, Azores, on timber).—GOURRET, 1888, p. 10 (Marseilles, on ships from the Atlantic and the Indies).—HEILPRIN, 1888, p. 320 (off Shelly Bay, Bermudas).—CHEVREUX and GUERNE, 1893, pp. 443–444 (lat. 37°55′ N., long. 0°40′ E., clinging to tail of turtle, *Thalassochelys caretta*; lat. 37°26′ N., long. 0°50′ E., clinging to tail of *Thalassochelys*).—ORTMANN, 1893, p. 58 (Florida Stream, on *Sargassum;* Sargasso Sea, on *Sargassum;* South Equatorial Current).—MILNE-EDWARDS, A., and BOUVIER, 1894, p. 49 (lat. 39°08′ N., long. 28°34′ W., on floating barrel; lat. 42°21′29″ N., long. 18°33′45″ W.; lat. 42°31′21″ N., long. 19°38′08″ W.; lat. 43°29′30″ N., long. 21°33′40″ W., on flotsam; Fayal, Horta, Azores, on rocks at low tide; lat. 42°02′26″ N., long. 44°05′30″ W., on *Sargassum;* lat. 39°20′30″ N., long. 33°29′40″ W., on flotsam).—ORTMANN, 1894, p. 710 (Oran; Africa; Atlantic Ocean; "Sargasso").—NUTTING, 1895, p. 29 (Gulf Stream, in *Sargassum*).—HODGSON, 1896, p. 178 (Plymouth Sound, England, on bottom of ship from Iquique, Peru; English Channel, 2–3 miles off Plymouth, on fragment of cork structure).—MILNE-EDWARDS, A., and BOUVIER, 1899, p. 37 (lat. 37°16–39′ N., long. 27°05–58′ W., on turtles, *Thalassochelys caretta;* lat. 39°12′ N., long. 33°09′ W., on flotsam; lat. 38°08′ N., long. 25°55′ W., on flotsam; lat. 38°26′ N., long. 28°51′ W.); 1900, p. 108 (off Ponte-Delgado, on *Sargassum*).—RANKIN, 1900, p. 526 (Bermuda, in tide-pools with *Pachygrapsus* among *Sargassum*).—YOUNG, 1900, p. 286 (part: not all distribution records).—HOWE, 1900, p. 240 (approx. lat. 40° N., long. 70° W.).—NORMAN and SCOTT, 1906, p. 5.—BOUVIER, 1907, p. 37 (variable coloration).—COULON, 1907, p. 123 [17] (Sargasso Sea).—NORMAN, 1907, p. 357 (Channel Islands).—STIMPSON, 1907, p. 121 (North Atlantic, between lat. 20–36° N., common on floating logs, seaweed (*Sargassum*), etc.).—NORMAN and BRADY, 1909, p. 9.—PESTA, 1918, p. 446, fig. 147 (Lesina).—BORASCHI, 1921, p. 10, pl. 1, fig. 9 (larvae: Quarto dei Mille; Palermo).—MIRANDA Y RIVERA, 1921, p. 189 (Playa de la Malagueta, Spain).—MONOD, 1932, p. 219 (Fedhala, Morocco, common on marine plants and other objects).

*Nautilograpsus major* MACLEAY, 1838, p. 66 (Cape of Good Hope).—KRAUSS, 1843, p. 44.—MILNE-EDWARDS, H., 1852, p. 175.

*Nautilograpsus smithii* MACLEAY, 1838, p. 67 (Cape of Good Hope).—KRAUSS, 1843, p. 44.—MILNE-EDWARDS, H., 1852, p. 175.

*Grapsus diris* COSTA, 1838–53, [p. 2, pl. 4, fig. 1 (color)] (Naples, "among rocks above water").—MILNE-EDWARDS, H., 1852, p. 175.

*Planes linnaeana* LEACH, 1815, pl. 27, figs. 1–3, and accompanying text (coasts of Devon and Cornwall).—BELL, 1844–53, p. 135, figs. (Devonshire; Cornwall).—WHITE, 1847, p. 41 (Devonshire; south Atlantic).—COCKS, 1849, p. 80 (Falmouth, England, from stomach of fish).—WHITE, 1850, p. 19 (Devonshire).—GOSSE, 1855, p. 159, fig. 302.—MCANDREW, 1860, p. 21.—LUKIS and LE LIEVRE, 1862, p. 232 (Guernsey, Channel Islands).—MARCUSEN, 1867, p. 359 (Black Sea).—CARRINGTON and LOVETT, 1882, p. 181 (Looe, Cornwall, among stalked barnacles on timber; Penzance, from soil and seaweed on derelict cask of paraffin).—CORNISH, 1882, p. 118 (off Penzance, England, from soil and seaweed growing on derelict cask of paraffin); 1884, p. 116 (near Penzance, England, from derelict water-logged barrel of paraffin drifted ashore).

*Planes minutus* WHITE, 1847, p. 42 ("Gulf of Florida;" Atlantic Ocean, on gulfweed).—DANA, 1852b, p. 346; 1854, p. 27.—CUNNINGHAM, 1870, p. 493

(south of Azores, on *Sargassum*); 1871, p. 501.—RATHBUN, 1897b, p. 29 (Kingston Harbor, Jamaica); 1898a, p. 288 (Dry Tortugas, in gulfweed; lat. 31°30′ N., long. 75°11′ W.); 1898b, p. 604, (part: lat. 31°16′ N., long. 71°50′ W.).—ORTMANN, 1899, p. 1188 (part).—RATHBUN, 1900a, p. 279; 1900b, p. 587 (part).—THOMPSON, D'A. W., 1901, p. 6 (Atlantic).—BORRADAILE, 1903, p. 432 (Male, Maldive Islands, on floating cuttlebone).—DOFLEIN, 1904, p. 130 (lat. 30°6.7′ S., long. 87°50.4′ E.).—MAYER, 1905, p. 102.—STEBBING, 1905, p. 43 (False Bay, South Africa).—RATHBUN, 1905, p. 4 (Woods Hole and Wareham, Mass.; Sakonnet Point, R. I., under rocks).—NOBILI, 1906, p. 321 (Djibouti).—VERRILL, 1908, p. 325, fig. 7, pl. 13, figs. *a–j′*, pl. 27, fig. 6 (off Bermuda).—LENZ, 1910, pp. 560, 574 (Ste. Marie, Madagascar).—STEBBING, 1910, p. 320 (South Africa: False Bay; 38 miles northwest of Rable Bay).—DOFLEIN and BALSS, 1912, p. 39 (part ?: lat. 44°32′ S., long. 61°25′ W.).—FOWLER, 1912, p. 443, pls. 140–141 (Cape May, N. J.).—MURRAY and HJORT, 1912, pp. 103, 633, 671, pl. 6 (color) (approx. lat. 36°05′ N., long. 43°58′ W.).—PESTA, 1912, p. 122 (Lesina).—SUMNER, OSBURN, and COLE, 1913, p. 675 (western part of Vineyard Sound, Mass., commonly on gulfweed).—LENZ and STRUNCK, 1914, p. 284 (off Madeira, on floating weed; off New Amsterdam Island, on *Macrocystis;* southeast of Madagascar; south of Azores, on *Sargassum*).—STEBBING, 1914a, p. 345 (Falkland Islands); 1914b, p. 266, pl. 24 (Saldanha Bay, South Africa; lat. 29°54′ N., long. 34°10′ W. to lat. 33°53′ N., 32°27′ W.).—BOUVIER, 1915, p. 127 (Port Louis, Mauritius).—HAY and SHORE, 1918, p. 448, pl. 36, fig. 6 (Beaufort, N. C.).—RATHBUN, 1918, p. 253 (part: off Woods Hole, Mass., to Florida and Bahamas; Azores; Indian Ocean; Kerguelen Island).—TESCH, 1918, p. 83 [footnote] (part: not all distribution records).—CROZIER, 1918, pp. 262–263 (Bermuda, on floating tree; coloration).—LUEDERWALDT, 1919, p. 435 (Iguape, São Paulo, Brazil).—BALSS, 1922a, p. 83 (Monrovia, West Africa).—BOUVIER, 1922, p. 74, pl. 2, fig. 2 (color) (east-central North Atlantic between lat. 28° and 39° N., and long. 23° and 43° W., on turtles, *Sargassum*, floating wood, etc.).—HYMAN, 1924, p. 5, pl. 1, figs. 1–10 (Beaufort Harbor, N. C.).—RATHBUN, 1924, p. 157 (off eastern Cuba, on *Sargassum*).—MONOD, 1927, p. 621 (Souelaba, Douala Bay, Cameroon, on floating tree trunk).—PERKINS, 1928, p. 53.—RATHBUN, 1929, p. 35, fig. 48 (off Nova Scotia).—NOBRE, 1931, p. 107, figs. 60–63 (Douro River, Portugal, on root of tree washed in by storm).—MONOD, 1933, p. 80.—RATHBUN, 1933, p. 89, fig. 83 (Puerto Rico; St. Thomas).—EKMAN, 1935, pp. 9, 425 (part, not fig.).—NOBRE, 1936, p. 63, pl. 24, fig. 45, pl. 46, fig. 45*a*.—MONOD, 1939, p. 567 (lat. 30°10′ N., long. 47° W., on *Sargassum*).—BOUVIER, 1940, p. 291, fig. 182.—HITCHCOCK, H. B., 1941, pp. 26–30 (Bermuda; color change).—LEBOUR, 1944, p. 114, fig. 4 (Bermuda, in *Sargassum;* larvae).—ZARIQUIEY ALVAREZ, 1946, p. 163, pl. 18, fig. b.

*Nautilograpsus diris* HELLER, 1863, p. 115.

*Nautilograpsus pelagicus* HELLER, 1863, p. 115.

*Nautilograpsus cyaneus* TARGIONI TOZZETTI, 1872, p. 8 (Sargasso Sea); 1877, p. 125, pl. 8, figs. 5*a–f* (Atlantic Ocean). Not *Planes cyaneus* Dana, 1852.

*Planes linneana* COUCH and BATE, 1878, p. 469 (English Channel off French coast, under tail of hawksbill turtle; Devon or Cornwall).

*Nautilus grapsus minutus* MORISON, 1942, p. 269.

*Planes* sp. WHITE, 1847, p. 42 (St. Kitts Island; Falkland Islands; Brazil; Swan River).—BEEBE, 1932, pp. 188–196 (Bermuda).

*Nautilograpsus* sp. MÜLLER, F., 1881, p. 473 (color change).

TABLE 4.—*Material examined of* Planes minutus [1]

| Locality | Latitude N. | | | Longitude W. | | | Surface temp. | Date | Station | Collector | Specimens | Catalog No.[2] | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ′ | ″ | ° | ′ | ″ | °F. | | | | | | |
| Off eastern North America south of Newfoundland. | 44 | 29 | -- | 52 | 53 | -- | -------- | Sept. 21, 1935 | ------ | A. H. Leim | 1♂ | 72195 | |
| Maine: | | | | | | | | | | | | | |
| New Harbor, Muscongus Bay. | -- | -- | -- | -- | -- | -- | -------- | Aug. 15, 1944 | ------ | L. W. Scattergood | 1♂ | 88063 | From loggerhead turtle. |
| Massachusetts: | | | | | | | | | | | | | |
| Georges Bank | 41 | 52 | -- | 66 | 24 | -- | -------- | Sept. 16, 1927 | ------ | W. C. Schroeder | 1 ovig. ♀ | 8720 (MCZ) | |
| Vicinity of Woods Hole | -- | -- | -- | -- | -- | -- | -------- | 1899 | ------ | B. A. Bean | 1♂ | 44672 | |
| Wareham | -- | -- | -- | -- | -- | -- | -------- | Aug. 12, 1898 | ------ | Outram Bangs | 1♂ | 5976 (MCZ) | Found alive on beach. |
| Rhode Island: | | | | | | | | | | | | | |
| Sakonnet Point | -- | -- | -- | -- | -- | -- | -------- | Sept. 13, 1904 | ------ | W. Nye, Jr. | 1 ovig. ♀ | 31476 | Under rocks. |
| 5–6 miles off Block Island | -- | -- | -- | -- | -- | -- | -------- | July 30, 1928 | ------ | A. K. Fisher | 1 ♂1 ovig. ♀ | 62510 | From hawksbill turtle. |
| New Jersey: | | | | | | | | | | | | | |
| East of | 40 | 50 | -- | 60 | 53 | -- | -------- | July 2, 1915 | ------ | C. W. Furlong, *Kitty A.* | 7♂ 2♀ | 53351 | From *Sargassum*. |
| Do | 40 | 34 | 30 | 66 | 48 | 00 | 67 | July 14, 1885 | 2532 | *Albatross* | 1♀ | 11038 | |
| Do | 40 | 10 | 15 | 70 | 26 | 00 | 64 | Sept. 26, 1884 | 2243 | *Albatross* | 3♂ 2♀ (1 ovig.) | 7285 | |
| Do | 39 | 59 | 40 | 70 | 41 | 10 | 68 | Sept. 20, 1883 | 2090 | *Albatross* | 1 ovig. ♀ | 5422 | |
| Do | 39 | 45 | 00 | 69 | 44 | 45 | 70 | Aug. 4, 1881 | 935 | *Fish Hawk* | 2♂ 1♀ | 4558 | 1 male figured. |
| | 39 | 49 | 25 | 69 | 49 | 00 | 72 | do | 937 | | | | |
| Do | 39 | 40 | -- | 71 | 30 | -- | 68 | Sept. 8, 1881 | 994 | *Fish Hawk* | 1♀ | 40519 | |
| Do | 39 | 34 | 15 | 71 | 41 | 15 | 74 | Aug. 19, 1884 | 2203 | *Albatross* | 4♂ 2 ovig. ♀ | 8220 | |
| Do | 39 | 29 | 00 | 70 | 58 | 40 | 69.5 | Sept. 30, 1883 | 2095 | *Albatross* | 1♂ | 15052 | |
| Do | 39 | 22 | 50 | 68 | 25 | 00 | 72 | July 30, 1883 | 2041 | *Albatross* | 4♂ 3 ovig. ♀ | 6515 | |
| Cape May Point | -- | -- | -- | -- | -- | -- | -------- | Sept. 24, 1928 | ------ | H. G. Richards | 1♀ | 74887 | |
| Maryland: | | | | | | | | | | | | | |
| East of | 38 | 19 | 26 | 68 | 20 | 20 | 81 | July 28, 1883 | 2039 | *Albatross* | 2♂ | 40520 | Carapace of smaller specimen figured. |
| North Carolina: | | | | | | | | | | | | | |
| East of | 36 | 20 | 24 | 74 | 46 | 30 | 69 | June 4, 1885 | 2425 | *Albatross* | 1♂ 2♀ | 17896 | |
| Edge of Gulf Stream off Cape Hatteras. | -- | -- | -- | -- | -- | -- | -------- | June 6, 1903 | ------ | B. A. Bean | 5♂ 6 ovig. ♀ | 31080 | From *Sargassum*. |
| 200 miles off Cape Hatteras | -- | -- | -- | -- | -- | -- | -------- | Oct. 1921 | ------ | *Carnegie* | 16♂ 15♀ (2 ovig.) | 60268 | Carapaces of three males figured. |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Beaufort | -- | -- | -- | -- | -- | -- | | July 16, 1912 | | W. P. Hay, *Fish Hawk* | 1♂ 1♀ | 51019 | From log with *Lepas* on shore. |
| Do | -- | -- | -- | -- | -- | -- | | | | Kinglsey (?) | 2♂ 1♀ | 56798 | |
| South Carolina: | | | | | | | | | | | | | |
| East of | 32 | 43 | 00 | 77 | 51 | 00 | 69 | Jan. 5, 1885 | 2314 | *Albatross* | 7♂ 7♀ (1 ovig.) 1 megalops. | 15053 | |
| Do | 32 | 33 | -- | 72 | 14 | -- | 66.5 | Jan. 30, 1914 | 10166 | *Bache* | 1♀ | 49957 | |
| Do | 32 | 29 | -- | 71 | 29 | -- | 66.1 | Feb. 1, 1914 | 10169 | *Bache* | 5♂ 4♀ | 49942 | |
| Do | 32 | 27 | -- | 69 | 55 | -- | 66.1 | Feb. 2, 1914 | 10171 | *Bache* | 9♂ 6♀ | 49946 | |
| Georgia: | | | | | | | | | | | | | |
| East of | 31 | 30 | -- | 75 | 11 | -- | | May 9, 1893 | | University of Iowa Bahama Expedition. | 1♂ 1♀ | 74517 | From *Sargassum*. |
| Do | 31 | 16 | -- | 71 | 50 | -- | | Nov. 23, 1887 | | *Albatross* | 19♂ 19♀ | 22098 | |
| Florida: | | | | | | | | | | | | | |
| St. Augustine | -- | -- | -- | -- | -- | -- | | | | E. Samuels | 1♂ 1 ovig. ♀ | 71132 | Do. |
| Florida Keys | -- | -- | -- | -- | -- | -- | | | | | 2♂ 6♀ (4 ovig.) | 5977 (MCZ) | |
| Key West | -- | -- | -- | -- | -- | -- | | Apr. 15–27, 1884 | | *Albatross* | 1♀ | 18448 | |
| Dry Tortugas | -- | -- | -- | -- | -- | -- | | | | University of Iowa | 1♂ | 68857 | |
| Bahamas and West Indies | | | | | | | | | | | | | |
| Bahamas: | | | | | | | | | | | | | |
| Northeast of Abaco Island | 28 | 51 | -- | 75 | 13 | -- | 70.8 | Feb. 28, 1914 | 10194 | *Bache* | 1♀ | 49940 | |
| Do | 28 | -- | -- | 75 | -- | -- | | June 15, 1903 | | Bean and Riley | 3♂ 2 ovig. ♀ | 31061 | |
| About 120 miles north by east of Abaco Island. | -- | -- | -- | -- | -- | -- | | do | | do | 6♂ 18♀ (10 ovig.). | 31081 | Do. |
| 60 miles north of Abaco Id | -- | -- | -- | -- | -- | -- | | June 16, 1903 | | B. A. Bean | 5♀ (4 ovig.) | 31079 | Do. |
| North of Abaco Island | 27 | 57 | 30 | 77 | 27 | 30 | 73 | May 2, 1886 | 2654 | *Albatross* | 5♂ 4♀ (2 ovig.) | 11399 | |
| Green Turtle Cay | -- | -- | -- | -- | -- | -- | | | | E. A. Andrews | 1♂ 2♀ | 20714 | |
| Between Nassau and Elbow Cay. | -- | -- | -- | -- | -- | -- | | July 21, 1903 | | B. A. Bean | 2♂ 1 ovig. ♀ | 31062 | |
| Eleuthera Island: 1 mile northeast of Governor's Harbor. | | | | | | | | May 14, 1936 | | W. J. Clench | 2♂ 2 ovig. ♀ | 9486 (MCZ) | Along open beach. |
| Between Nassau and Cat Island. | | | | | | | | Mar. 18, 1937 | | W. L. Schmitt | 2♂ | 75155 | |

See footnotes at end of table.

TABLE 4.—*Material examined of* Planes minutus [1]—Continued

| Locality | Latitude N. | Longitude W. | Surface temp. | Date | Station | Collector | Specimens | Catalog No.[2] | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° F. | | | | | | |
| Bahamas—Continued | | | | | | | | | |
| Exuma Sound | 24 30 43 | 76 23 45 | 73 | Mar. 13, 1886 | 2632 | *Albatross* | 1♂ | 11409 | |
| Rum Cay | | | | Feb. 13, 1934 | | T. Barbour and J. Greenway. | 1♂ 3♀ (2 ovig.) | 8974 (MCZ) | |
| Off eastern Cuba | | | | 1923 | 12h | Williams Galapagos Expedition. | 2♀ (1 ovig.) | 57739 | From *Sargassum*. |
| Do | | | | 1923 | 12j | do | 2♂ | 57738 | |
| Haiti | | | | | | Dr. Weinland | 1♂ | 5982 (MCZ) | |
| North of St. Thomas | 20 -- -- | 63 -- -- | | | | Dr. Kershner | 7♂ 5♀ (2 ovig.) | 6714 | |
| St. Thomas | | | | Jan. 17–24, 1884 | | *Albatross* | 1♀ | 18563 | |
| Do | | | | | | *Hassler* | 23♂ 22♀ 169y | 5981 (MCZ) | |
| Jamaica: Kingston Harbor | | | | May–July 1896 | | F. S. Conant | 1♂ 1 ovig. ♀ | 19600 | |
| Swan Island, Caribbean Sea | | | | 1916 | | George Nelson | 1 ovig. ♀ | 9077 (MCZ) | |
| Bermudas | | | | | | F. V. Hamlin | 6♂ 8♀ (1 ovig.) | 4027 | |
| Do | | | | 1876–77 | | G. Brown Goode | 12♂ 14♀ (4 ovig.) | 43047 | |
| Do | | | | | | Walter Faxon | 1♂ 1♀ | 5980 (MCZ) | |
| Do | | | | | | Bermuda Biological Station. | 9♂ 5♀ | 7692 (MCZ) | |
| Do | | | | Jan. 8, 1903 | | do | 6♂ 13♀ (7 ovig.) | 8420 (MCZ) | Do. |
| Do | | | | July 2, 1903 | | | 12♂ 9♀ (6 ovig.) 1y. | 9089 (MCZ) | Do. |
| Do | | | | Mar. 10, 1916 | | | 15♂ 13♀ (5 ovig.) | 9109 (MCZ) | |
| North shore | | | | Jan. 12, 1882 | | G. Howes | 2♂ 8♀ | 5170 | In floating seaweed. |
| Agers Island | | | | Apr. 1928 | | E. Deichmann | 30♂ 15♀ (6 ovig.) | 65645 | From *Sargassum* thrown up on shore. Carapaces of 2 males figured. |
| Hamilton Island | | | | Mar. 3–7, 1910 | | T. Barbour | 17♂ 12♀ (7 ovig.) | 9114 (MCZ) | |
| South shore of Long Bird Island. | | | | June 13–18, 1936 | | F. A. Chace, Jr | 1 ovig. ♀ | 9229 (MCZ) | On beach. |
| Northwest of | 32 30 -- | 65 48 -- | 66.6 | Feb. 5–6, 1914 | 10176 | *Bache* | 7♂ 3♀ | 49944 | |
| Southwest of | 30 27 -- | 66 05 -- | 68.2 | Feb. 19, 1914 | 10182 | *Bache* | 3♂ 4♀ (3 ovig.) | 49945 | |
| Do | 30 27 -- | 66 05 -- | 68.2 | do | 10182 | *Bache* | 1♀ | 49948 | |
| Do | 29 17 -- | 67 07 -- | 68.1 | Feb. 21, 1914 | 10184 | *Bache* | 14♂ 8♀ (3 ovig.) | 49943 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Do | 28 51 -- | 70 08 -- | 67 | Feb. 24, 1914 | 10188 | *Bache* | 2♂ 2♀ | 49941 | |
| Do | 28 51 -- | 70 08 -- | 67 | do | 10188 | *Bache* | 1♂ 1♀ | 49947 | |
| Do | 31 15 42 | 67 39 10 | | Jan. 13, 1884 | Hyd. 37 | *Albatross* | 44♂ 50♀ (4 ovig.) | 7744 | |
| 400 miles southeast of | | | | | | Crosby | 2 ovig. ♀ | 74916 | |
| Mid-Atlantic | 38 50 -- | 42 40 -- | | Apr. 27, 1859 | | O. Dabney | 8♂ 13♀ | 1593 (MCZ) | |
| Do | 38 50 -- | 42 40 -- | | | | do | 1 ovig. ♀ | 8790 (MCZ) | |
| Do | 32 -- -- | 36 -- -- | | July 5, 1860 | | D. D. Raulet | 13♂ 16♀ (10 ovig.) 4y. | 8787 (MCZ) | |
| Do | 29 23 -- | 37 08 -- | | Feb. 22, 1861 | | do | 20♂ 21♀ (3 ovig.) 47y. | 5990 (MCZ) | |
| Do | 21 -- -- | 51 -- -- | | | | C. C. Craft | 1♂ 2♀ | 44671 | |
| Do | 11 05 -- | 50 01 -- | | | | C. W. Furlong, *Kitty A* | 7♂ 13♀ (3 ovig.) | 53350 | |
| Azores: | | | | | | | | | |
| Fayal | | | | | | O. Dabney | 1♂ 1 ovig. ♀ | 5983 (MCZ) | |
| 3 miles off Fayal Harbor | | | | Jan. 1893 | | Lewis Dexter | 3♂ 3♀ | 17712 | From log. Parts of largest and smallest males figured. |
| Madeira Islands: | | | | | | | | | |
| Bay of Funchal | | | | Aug. 1921 | | Adolfo Cesar de Noronha. | 1♀ | 55365 | From floating timber. |
| Do | | | | Sept. 1921 | | do | 1♂ | 55366 | |
| Canary Islands: Tenerife | | | | | | | 3♂ 4♀ (1 ovig.) | 72521 | |
| Indian Ocean | 90° E. on Equator | | | Feb. 1884 | | Capt. J. R. Lyon, *Cashmere.* | 5♂ 9♀ (2 ovig.) | 13914 | |
| Kerguelen Island (?) | | | | Sept. 28, 1874 | | J. H. Kidder | 1♀ | 15054 | |

[1] Including only lots for which the locality data are apparently valid and reasonably exact.

[2] Unless otherwise noted, catalog numbers refer to specimens in the U. S. National Museum; (MCZ) stands for the Museum of Comparative Zoology, Cambridge, Mass.

**PLANES CYANEUS Dana**

*Cancer cantonensis* LINNAEUS, 1747, p. 137, pl. 1, figs. 1a–b (Canton [?]).

*Grapsus pusillus* HAAN, 1835, p. 59, pl. 16, fig. 2.—MILNE-EDWARDS, H., 1852, p. 175. Not *Cancer pusillus* Fabricius, 1775.

*Nautilograpsus minutus* MILNE-EDWARDS, H., and LUCAS, 1843, p. 28 (record from off Valparaiso credited to Eydoux).—NICOLET, 1849, p. 168 (Valparaiso Bay).—JACQUINOT and LUCAS, 1853, p. 78 (Port Famine, Straits of Magellan, very abundant).—STIMPSON, 1860, p. 231 [103] (Cape San Lucas, Baja California).—MAN, 1879, p. 69 (part: Japan; New Guinea).—KINGSLEY, 1881, p. 202 (part: Peru; west coast of Mexico; Alaska; China; New Zealand; Falkland Ids. [?]).—MIERS, 1886, p. 254 (part: South Pacific, near Kermadec Islands, among seaweed; North Pacific, off Volcano Island; off Japan).—LENZ, 1901, p. 472 (between Honolulu and San Francisco). Not *Cancer minutus* Linnaeus, 1758.

*Planes cyaneus* DANA, 1852a, p. 250 (lat. 28° N., long. 174° E.); 1852b, p. 347 (lat. 15°50′ S., long. 105° W.); 1853, p. 1593; 1855, pl. 22, fig. 1.—WARD, 1939, p. 14 (lat. 29°20′ N., long. 141°25′ W.).

*Nautilograpsus angustatus* STIMPSON, 1858, p. 103 [49] (lat. 34° N., long. 155° E.); 1907, p. 121, pl. 16, fig. 1 (lat. 34° N., long. 151° W.).

*Planes minutus* MIERS, 1876, p. 39 (New Zealand).—HASWELL, 1882, p. 99.—FILHOL, 1885, p. 390.—FAXON, 1895, p. 30 (lat. 00°13′00″ S., long. 84°52′00″ W.; lat. 2°34′00″ N., long. 92°06′00″ W.; off Acapulco, Mexico; all on green turtles).—RATHBUN, 1898b, p. 604 (part: lat. 1°03′ N., long. 80°15′ W.; Gulf of California).—ORTMANN, 1899, p. 1188 (part).—RATHBUN, 1900b, p. 587 (part); 1902, p. 278 (about 200 miles north of Wenman Island, Galápagos, at base of tail of green turtle); 1904, p. 189 (lat. 41° N., long. 141° W.; Point Loma, Calif.; off San Diego, Calif.).—FULTON and GRANT, 1906, p. 19.—RATHBUN, 1906, p. 840 (between Erben Bank and Kaiwi Channel, on *Velella:* south coast of Oahu Island; south coast of Molokai Island, on floating stick).—RATHBUN, 1907, p. 69 (south of Gulf of California; off Guatemala; off Peru); 1910, pp. 589, 610–614, 616.—WEYMOUTH, 1910, p. 63, pl. 14, fig. 44.—CHILTON, 1911, p. 561 (Kermadec Islands).—DOFLEIN and BALSS, 1912, p. 39 (part: Smith Channel, Straits of Magellan).—RATHBUN, 1918, p. 253, pl. 63 (part: Humboldt Bay, Calif., to Peru; Galápagos Islands; Hawaiian Islands; Marquesas Islands; Japan; Mauritius).—TESCH, 1918, p. 83 [footnote] (part).—SCHMITT, 1921, p. 272, pl. 46, figs. 1–2 (La Jolla, Calif.; off Point Loma, Calif.).—BALSS, 1922b, p. 149 (Ogasawara Island).—BALSS, 1924, p. 336 (Juan Fernández Island).—URITA, 1926, p. 23 (off Ohsima, Ohsumi, Japan).—HALE, 1927, p. 181, fig. 182.—CHILTON and BENNETT, 1929, p. 768 (Moko Hinau, New Zealand, washed ashore on piece of pumice).—SIVERTSEN, 1933, p. 21.—GLASSELL, 1934, p. 302 (Gulf of California).—SAKAI, 1934, p. 323 (Japan).—EKMAN, 1935, p. 9, fig. 3 (not p. 425).—SAKAI, 1936, p. 226, fig. 120 (Japan).—AIKAWA, 1937, p. 152 (larvae).—CRANE, 1937, p. 77 (Santa Inez Bay, Mexico, on tail of green turtle; food).—SAKAI, 1939, p. 664, pl. 108, fig. 2 (Misaki, from turtle; Odawara, Sagami Bay; Simoda, on *Sargassum;* Ise Bay; Seto; Tosa Bay; Nagasaki; northern Daitozima; Tansui, Formosa).—STEINBECK and RICKETTS, 1941, pp. 45, 474 (south of Point Abrojos, Baja Calif., in folds of skin beside tail of tortoiseshell turtle, *Eretmochelys imbricata* [on flipper, p. 474]).—EDMONDSON, 1946, p. 306, fig. 183f (Hanauma Bay, Oahu Island).—POPE, 1948, pp. 296–297, fig.—RICHARDSON, 1949, p. 34, pl. 2, fig. 16. Not *Cancer minutus* Linnaeus, 1758.

*Nautilograpsus pusillus* MAN, 1879, p. 69. Not *Cancer pusillus* Fabricius, 1775.

*Planes marinus* WARD, 1939, p. 14 (lat. 32° 00′ N., long. 135°20′ W.; lat. 29°20′ N., long. 141°25′ W.). Not *P. marinus* Rathbun, 1914.

TABLE 5.—*Material examined of* Planes cyaneus [1]

| Locality | Latitude (N.) | Longitude (W.) | Surface temp. | Date | Station | Collector | Specimens | Catalog No.[2] | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Off southern California; | ° ′ ″ | ° ′ ″ | ° F. | | | | | | |
| San Pedro | | | | | | H. N. Lowe | 1♀ | 32975 | |
| Santa Catalina Island: Avalon Bay. | | | | Oct. 22, 1910 | | P. S. Barnhart, *Anton Dohrn.* | 1♀ | 50269 | |
| WSW. of San Nicholas Island. | 33 02 15 | 120 36 30 | 61–62 | Mar. 28, 1904 | 4391 | *Albatross* | 1♀ | 44674 | |
| Off San Diego | 32 47 30 | 118 10 00 | 59 | Jan. 23, 1889 | 2928 | *Albatross* | 1♂ | 17450 | |
| Point Loma | | | | Jan. 28, 1889 | | *Albatross* | 1♂ 1♀ | 17449 | |
| Off Pacific coast of Mexico: | | | | | | | | | |
| Baja California: | | | | | | | | | |
| Turtle Bay | | | | Aug. 1, 1896 | | A. W. Anthony | 1♂ 1 ovig. ♀ | 19517 | |
| San José del Cabo | | | | | | do | 1♀ | 20694 | |
| Gulf of California | | | | Apr. 29, 1888 | | *Albatross* | 2♂ 1♀ | 22101 | |
| Escuinapa, Sinaloa | | | | | | Direc. Forest. y de Casa y Pesa. | 1 ovig. ♀ | 60238 | |
| Off Cabo Corrientes, Jalisco | 20 00 -- | 106 12 -- | 81–83 | Oct. 12, 1904 | 4587 | *Albatross* | 1♀ | 33214 | |
| San Benedicto Island | | | | | | A. W. Anthony | 1♂ 1♀ | 20695 | Male figured. |
| Clarion Island | | | | | | do | 2♂ 3♀ (1 ovig.) | 20700 | Walking leg figured. |
| Off Acapulco | | | | Feb. 10, 1891 | | *Albatross* | 1♂ | 20624 | From Green Turtle. |
| Salina Cruz, Oaxaca | | | | Dec. 25, 1898 | | Chas. C. Deam | 1♂ 1♀ | 32262 | On sand beach. |
| Off Guatemala | 12 20 -- | 92 13 -- | 85 | Oct. 17, 1904 | 4605 | *Albatross* | 1♂ | 33215 | Carapace figured. |
| Off Panama: Taboga Island | | | | May 12–15, 1911 | | Meek and Hildebrand | 1♂ 1♀ | 44173 | |
| Between Panama and Galápagos Islands. | 4°–5° | 83°–85° | | Apr. 1, 1888 | | *Albatross* | 1♂ | 22100 | |
| Northwest of Galápagos Islands | 2 34 00 | 92 06 00 | 82 | Apr. 5, 1891 | 3413 | *Albatross* | 2♂ 2 ovig. ♀ | 4493 (MCZ) | From Green Turtle. |
| Off Ecuador | 1 03 -- | 80 15 -- | | | | *Albatross* | 1♀ | 22097 | |
| Off Peru: | | | | | | | | | |
| Paita | | | | Aug. 12, 1884 | | W. H. Jones | 1♂ 1♀ | 14093 | Carapace of male figured. |

See footnotes at end of table.

TABLE 5.—*Material examined of* Planes cyaneus [1]—Continued

| Locality | Latitude (S.) | Longitude (W.) | Surface temp. | Date | Station | Collector | Specimens | Catalog No.[2] | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Off Peru—Continued | ° ′ ″ | ° ′ ″ | ° F. | | | | | | |
| West of Paita | 5 17 -- | 85 20 -- | 70–71 | Nov. 10, 1904 | 4649 | *Albatross* | 2♀ | 33213 | |
| Off Juan Fernández Islands, Chile. | | | | Dec. 18, 1926 | | W. L. Schmitt | 1♀ | 70886 | |
| Do | | | | Dec. 10, 1926 | | do | 1♂ | 70992 | |
| 40 miles east of | | | | Sept. 13, 1944 | U-42 -264 | U. S. Fish. Miss. in Chile. | 1♂ | 81058 | From drifting life raft. Carapace figured. |
| | *Latitude* (N.) | | | | | | | | |
| West of California | 41 -- -- | 141 -- -- | | Sept. 7, 1871 | | W. H. Dall | 1♂ | 15051 | Carapace figured. |
| Do | 36 25 -- | 143 04 -- | | Aug. 25, 1945 | | M. F. Groves | 8♀ (5 ovig) | 82012 | From floating wooden box. |
| Between California and Hawaiian Islands. | 32 00 -- | 135 20 -- | | | | *Zaca* | 1♂ | 7485 (AMNH) | Identified as *Planes marinus* by M. Ward. |
| Do | 30 56 -- | 139 50 -- | | Apr. 26, 1884 | | Lt. G. M. Stoney | 3♂ 1♀ | 13617 | |
| Do | 28 23 00 | 141 41 05 | 66 | Mar. 19, 1902 | 3800 | *Albatross* | 1♂ | 29347 | |
| Do | 28 23 00 | 141 41 05 | 66 | do | do | *Albatross* | 1♂ | 29348 | From *Velella*. |
| Do | 27 55 -- | 144 15 -- | | | | *Zaca* | 1♂ | 7484 (AMNH) | Identified as *P. cyaneus* by M. Ward. |
| Hawaiian Islands: | | | | | | | | | |
| Molokai Island: Off south coast. | | | 76 | Apr. 2, 1902 | 3833 | *Albatross* | 1♂ | 29345 | From floating stick. Carapace figured. |
| Oahu | | | | | | W. J. Thompson | 1♂ | 88066 | |
| Off south coast | | | 74 | Mar. 28, 1902 | 3813 | *Albatross* | 1♂ | 29346 | Carapace figured. |
| Malae Kahana | | | | | | C. M. Cooke, Jr | 1♀ | 88068 | |
| Midway Island | | | | April 1941 | | V. D. P. Spicer | 1♀ | 88065 | |
| Baker Island | | | | | | Capt. J. Hammond | 1♂ 3♀ | 5992 (MCZ) | One female appears to be *P. minutus*. |
| Mauritius | | | | 1891 (?) | | H. A. Ward | 1♀ | 17667 | |

[1] Including only lots for which the locality data are apparently valid and reasonably exact.

[2] Unless otherwise noted, catalog numbers refer to specimens in the U. S. National Museum; (MCZ) stands for the Museum of Comparative Zoology, Cambridge, Mass., and AMNH for the American Museum of Natural History, New York City.

TABLE 6.—*Material examined of* Pachygrapsus marinus

| Locality | Latitude (N.) | Longitude (W.) | Surface temperature | Date | Station | Collector | Specimens | Catalog No.[1] | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | ° F. | | | | | | |
| Oregon: Lincoln Beach | | | | Dec. 29, 1947 | | Ordnance Officer 13th Naval District. | 3♂ | 88069 | From Japanese mine. Walking leg figured. |
| Do | | | | do | | do | 1♂ | (WHOI) | From Japanese mine. |
| West of Baja California | 23 49 -- | 127 50 -- | | | | D. D. Raulet | 1♂ 1♀ | 22833 | Paratypes. Male figured. |
| Do | 23 49 -- | 127 50 -- | | | | do | 27♂ 14 ovig. ♀ | 87988 | Paratypes. Carapaces of several males figured. |
| Hawaiian Islands: | | | | | | | | | |
| Oahu | | | | | | C. M. Cooke, Jr | 2♂ | 88070 | |
| Do | | | | July 8, 1916 | | C. M. Cooke, III | 1♂ 1♀ | 88064 | |
| Mokapu | | | | July 1, 1932 | | C. H. Edmondson | 1♂ 1♀ | 88067 | Found beside drift log. |

[1] Catalog numbers refer to specimens in the U. S. National Museum; (WHOI) stands for the Woods Hole Oceanographic Institution, Woods Hole, Mass.

## Genus PACHYGRAPSUS Randall

### PACHYGRAPSUS MARINUS (Rathbun)

*Planes marinus* RATHBUN, 1914, p. 120, pl. 3 (lat. 23°49′ N., long. 127°50′ W.); 1918, p. 258, pl. 64.—TESCH, 1918, p. 83 [footnote].—GLASSELL, 1934, p. 302.

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